be a direct sequela to this reaction, is a separation of the wound edges when some of the skin sutures (silk) are removed routinely on the fifth day. The linear extent of this separation is determined by the remaining skin sutures.

Although diligently sought for, passive transfer of antibodies and precipitins, in blood serum as well as wound serum, could not be demonstrated. This suggests that the reaction is confined to the skin and/or muscles as a local manifestation, or in these tissues as a specific reacting system.

The patients were investigated for speed with which the catgut underwent lysis and, although fragmentary, the data suggest that the rate of lysis is proportional to the degree of sensitivity.

In order to ascertain the possible influence of sensitivity upon wound healing, a group of 184 consecutive thoracoplasty wounds were studied, and the incidence of complications plotted by stages. These are represented by Curves 3 and 4 of Chart 1. Curve 3 represents the percentage of all complications by stages. Curve 4 represents the percentage of complications exclusive of frank infections at the same periods. Eighteen complications, or a 9.7 per cent incidence, were recorded. Of these, 11 or 5.9 per cent were infectious (Staphylococcus aureus, or tubercle bacilli); seven or 3.8 per cent, were of other types. These corresponded to the above described sequela to catgut sensitivity.

Superimposing these curves, strikingly presents their similarity. There were a total of 12 operations beyond the fifth stage, without complications.

Thus, evidence has been presented that:

Sensitivity to catgut used in rather large doses, and repeatedly, can be demonstrated by means of a skin test, and the curve of the sensitivity closely corresponds to the immunologic response to the commonly used antigens.

It is intimated that, in sensitized individuals, lysis of the suture material occurs more rapidly than in the nonsensitized person.

The sensitization to catgut appears to be a purely local reaction, confined to the tissues as a reacting system, since no evidence of systemic response has been seen.

When the wound complications occur, they do so with amazing frequency at a period in the evolution of the thoracoplasty when sensitivity is highest, as demonstrated by skin tests. It is believed that in presence of a hypersensitive response to catgut, the fundamental difficulty is a delay in the fibroblastic phase.

The exact component of a catgut suture which acts as an antigen cannot be determined from this study alone.

The skin test has no practical significance in sorting suitable candidates for catgut closures, because it is often only after one or two stages that sensitivity becomes demonstrable.

TWO DISTINCT TYPES OF DEHYDRATION*

A Preliminary Report

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AS SEEN CLINICALLY, dehydration is of two main types or some combination of the two, depending upon whether it is due to (1) shortage of water; (2) shortage of electrolytes; or (3) to both of these factors working simultaneously. As shown in rabbits, by Kerpel-Fronius[1] in 1935, these two types are not merely slight variations of the same thing but are essentially different conditions. They differ in mechanism of production, in symptomatology, and in the treatment indicated.

The contrast between the two types is well shown in the following four experiments which were performed upon normal human subjects.

In the first two experiments, the subjects swallowed Miller-Abbott tubes, the tips of which were passed into the jejunum and allowed to remain there for four or five days while constant suction was applied. The urinary output was kept at a normal

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level by the daily administration of salt-free water.

As a result of the Miller-Abbott suction, one subject lost 8.4 Gm. of sodium and 13.9 Gm. of chloride (equivalent to a loss of about 22 Gm. of NaCl). The other subject lost 9.0 Gm. of sodium and 15.6 Gm. of chloride (equivalent to approximately 24 Gm. of NaCl). Both subjects lost weight, developed weakness, apathy, anorexia, hypotension (80 and 85 Mm.Hg. systolic pressure, respectively), and orthostatic fainting. Both showed a marked hemoconcentration, with rise in hematocrit and in plasma protein concentration. So-called "classic signs of dehydration" such as thirst and oliguria were entirely absent. Administration of salt-free water had no effect in alleviating this condition, but Ringer's solution brought about prompt and complete recovery.

In the third and fourth experiments, the subjects were dehydrated by means of water deprivation. The subjects lost weight, developed marked thirst, oliguria, and azotemia. They did not excrete a significantly increased amount of sodium or chloride in the urine. There was no significant hemoconcentration, mental apathy or anorexia. Administration of distilled water resulted in prompt recovery, in contrast to the findings in the first two experiments.

The essence of the "salt-loss" type of dehydration, we believe, is a reduced volume of extracellular fluid.[1, 2, 3] This change is well reflected in the plasma by hemoconcentration. The symptoms are those seen in impending shock and are undoubtedly due chiefly to the reduction in blood volume and corresponding circulatory impairment.

The essence of the "water-loss" type of dehydration (true dehydration) is a simple shortage of body water in relation to the quantity of solutes present in this water.[1] This concentration of solutes is associated with thirst.

The clinical counterpart to these experiments is evident. In diarrhea, in various types of intestinal fistulae, in profuse sweating, and in Addison's disease we often find the extracellular type of desiccation in its pure form. In marked dysphagia, or any condition giving rise to simple water deprivation, we find true dehydration in the literal sense. In severe vomiting from any cause, we generally encounter a mixed type of dehydration, because a vomiting patient is likely to have both a restricted intake of water and also an abnormal loss of electrolytes. The therapeutic implications are obvious. To correct thirst, oliguria, and extrarenal azotemia, water or glucose solution is needed. To correct manifestations of extracellular desiccation, saline fluids are needed. Since many patients have both forms of dehydration, both of these types of fluid are frequently needed. We have many times emphasized the need for choosing the proper kind and amount of each solution and have developed simple rules for their selection.[4]

REFERENCES

1 Kerpel-Fronius, E.: Über die Beziehung zwischen Salz-und Wasserhaushalt bei experimentellen Wasserverlusten. Ztschr. f. Kinderh., **57**, 489, 1935.

2 Gamble, J. L., Ross, G. S., and Tisdall, F. F.: The Metabolism of Fixed Base During Fasting. Jour. Biol. Chem., **57**, 633, 1923.

3 Darrow, D. C., and Yannet, H.: Metabolic Studies of the Changes in Body Electrolyte and Distribution of Body Water Induced Experimentally by Deficit of Extracellular Electrolyte. Jour. Clin. Invest., **15**, 419, 1936.

4 Coller, F. A., and Maddock, W. G.: Water and Electrolyte Balance. Surg., Gynec., and Obstet., **70**, 340, 1940.

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